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NATO ASI at Windsor, 13-26 August

PROGRAMME

13 August 2001 – arrival

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

p.m. 6:00 Reception party
7:00 Dinner

14 August 2001

a.m. 9:45 Opening Session; **Giamarchi**, *An Introduction to Bosonization*
11:45 **Giamarchi**, *Pinned Elastic Structures and Fermion Localization*

p.m. 3:30 **Fisher**, *Electron Fractionalization in Two-Dimensional Correlated Systems,* I
5:15 **Sivan,** *Harnessing Biology to the Assembly of Non-biological Functional Nanostructures*

15 August 2001

a.m. 8:45 **Fisher**, *Electron Fractionalization in Two-Dimensional Correlated Systems,* II
10:00 **Giamarchi**, A *Variational Approach to Pinning*
11:45 **Affleck**, *Sine-Gordon Solitons and Breathers in the S=1/2 Chain Compound* Cu *Benzoate*

p.m. 3:30 **Sivan,** *Compressibility Measurements in Strongly Correlated 2D Systems*
5:15 **Georges**, *Dynamical Mean Field Theory, I*

16 August 2001

a.m. 8:45 **Affleck**, *Theory of Electron Spin Resonance in S=1/2 Antiferromagnetic Chains*
10:00 **Fisher**, *Electron Fractionalization in Two-Dimensional Correlated Systems,* III
11:45 **Georges**, *Dynamical Mean Field Theory,* II

p.m. 3:30 **Georges**, *Kondo Effect in Mesoscopics*
5:15 **Kukushkin**, *Magneto-optics of Composite Fermions*

17 August 2001

a.m. 8:45 **Affleck**, *Observing the Kondo Screening Cloud around a Quantum Dot*

10:00 **Giamarchi**, *The Wigner Crystal in Higher Dimensions*

p.m. 2:00 Posters Presentations

3:30 Poster Session I

18 August 2001

a.m. 8:45 **Altshuler**, *Weak Localization – Introduction*

10:00 **Altshuler**, *From Anderson localization to Quantum Chaos*

11:45 **Falko**, *Mesoscopic Fluctuations in Quantum Dots,* I

p.m. 3:30 **Falko**, *Mesoscopic Fluctuations in Quantum Dots,* II

5:15 **Bouchiat**, *Coherent Transport through Carbon Nanotubes*

19 August 2001, Sunday

Free Day (Excursion to Windsor Castle)

20 August 2001

a.m. 8:45 **Simons,** *Phase Coherence Phenomena in Disordered Superconductors: Phenomenology*

10:00 **Falko,** *Effects of the Interplay Between Spin-Orbit Coupling and Zeeman Splitting in Chaotic Quantum Dots*

11:45 **Savchenko**, *Metal-Insulator Transition in Dilute 2D Electron and Hole Gases*

p.m 2:00 Poster Presentations

3:30 Poster Session II

21 August 2001

a.m. 8:45 **Yurkevich**, *Bosonisation from Hubbard-Stratonovich Transformation*

10:00 **Simons,** *Phase Coherence Phenomena in Disordered Superconductors: Nonlinear Sigma Model*

11:45 **Simons,** *Non-Perturbative Phenomena: Instantons and Sub-Gap States*

p.m. 3:30 **Altshuler**, *Phase relaxation of electrons in disordered conductors*

5:15 **Pepper**, *Observation of Interaction Effects in One Dimensional Electron Transport*

22 August 2001

Free Day (Organised Tour to London and Transport to London)

23 August 2001

a.m. 8:45 **Aleiner,** *Interaction Effects in Disordered Systems: Transport at Low and Intermediate Temperatures*

10:30 **Aleiner,** *Interaction Effects in Disordered Systems: Zero Bias Anomaly*

11:45 **Lerner,** *Replicated Sigma Model in Mesosopic Physics: Non-Perturbative Results?*

p.m. 3:30 **Kamenev,** *Keldysh tecniques for out-of-Equilibrium Disordered Systems*

5:15 **Kouwenhoven,** *Direct Coulomb and Exchange Interaction in Artificial Atoms and Quantum Dots: an Experimental Overview,* I

24 August 2001

a.m. 8:45 **Aleiner,** *Interaction Effects in Quantum Dots*

10:00 **Gefen,** *Quantum Interference and Electron-Electron Interactions—Problems Solved and to be Resolved,* I

11:45 **Lerner,** *Nonlinear Sigma Model for Interaction and Superconductivity*

p.m. 3:30 **Kouwenhoven,** *Direct Coulomb and Exchange Interaction in Artificial Atoms and Quantum Dots: an Experimental Overview,* II

5:15 **Muzykantskii,** *Spectral decomposition of Geodesic flow on constant negative curvature surfaces*

25 August 2001

a.m. 8:45 **Gefen,** *Quantum Interference and Electron-Electron Interactions—Problems Solved and to be Resolved, I*

10:00 **Kamenev**, *Quantum Mechanics of Classical Lattice Models*

26 August 2001 - Departure

Every day: 7:45-8:45 Breakfast

11:15-11:45 Coffee break

1:00 –2:00 Lunch

4:45-5:15 Coffee break

7:00 Dinner

Abstracts for Poster Sessions

Fermi gas response to non-adiabatic switching of external potential

Y. Adamov and B. Mouzykantskii

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and Department of Physics, Belarusian State University, Minsk, Belarus

We compute analytically the distribution function $P(E)$ for the energy E acquired by a Fermi gas after being subjected to an arbitrary time-dependent external potential (switching event). We relate the distribution function to a solution of a matrix Riemann-Hilbert problem and present explicit formulae for the low order cumulants of $P(E)$. These general results are used to find the distribution of dissipated energy in a biased quantum point contact.

Integrable models for confined fermions: applications to metallic grains

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Istituto Nazionale per la Fisica della Materia, Unitá di Catania, Italy

We study integrable models for electrons in metals when the single particle spectrum is discrete. The electron-electron interactions are BCS-like pairing, Coulomb repulsion, and spin exchange. The corresponding couplings are, in general, nonuniform in the sense that they depend on the levels occupied by the interacting electrons. By using the realization of spin $1/2$-operators in terms of electrons the models describe spin $1/2$ models with nonuniform long range interactions and external magnetic field. The integrability and the exact solution arise since the model Hamiltonians can be constructed in terms of Gaudin models. Uniform pairing and the resulting orthodox model correspond to an isotropic limit of the Gaudin Hamiltonians. We discuss possible applications of this model to a single grain and to a system of few interacting grains.

Correlations in the Sine-Gordon Model with Finite Soliton Density

D.N. Aristov[1,2], and A. Luther [1]
[1] *NORDITA, Blegdamsvej 17, DK-2100, Copenhagen, Denmark*
[2] *Petersburg Nuclear Physics Institute, Gatchina 188300, Russia.*

We study the sine-Gordon (SG) model at finite densities of the topological charge and small SG interaction constant. This model is relevant, e.g., to the Hubbard model close to half-filling and to Heisenberg s=1/2 antiferromagnet in uniform and staggered magnetic fields. Using the semiclassical approach, we find that the spectrum of the Gaussian fluctuations around the classical solution reproduces the results of the Bethe ansatz studies. The modification of the collective coordinate method allows us to write down the action, free from infra-red divergencies. The behaviour of the density-type correlation functions is non-trivial and we demonstrate the existence of leading and sub-leading asymptotes. A consistent definition of the charge-raising operator is discussed. The superconducting-type correlations are shown to decrease slowly at small soliton densities.

Quantum and classical localization in two-dimensional network models

Eleanor Beamond, John Cardy and John Chalker
University of Oxford

A mapping between certain quantum and classical localization problems is demonstrated. By this means, classical statistical physics may be used to probe some properties of quantum systems such as their density of states and mean conductance. These random classical problems are also equivalent to certain kinds of interacting random walks. Thus investigation of these walks may uncover new universality classes for quantum localization transitions. Interacting walks on the L-lattice are equivalent to percolation hulls and yield critical exponents for the spin quantum Hall transition. However, the equivalent problem on the Manhattan lattice appears to have a trivial critical point; its scaling behaviour is exhibited.

Measuring Fractional Charge in Carbon Nanotubes

Cristina Bena, Smitha Vishveshwara, Leon Balents, and Matthew P. A. Fisher
University of California, Santa Barbara, USA

The Luttinger model of the one-dimensional Fermi gas is the cornerstone of modern understanding of interacting electrons in one dimension. In fact, the enormous class of systems whose universal behavior is adiabatically connected to it are now deemed Luttinger liquids. Recently, it has been shown that metallic single-walled carbon nanotubes are almost perfectly described by the Luttinger Hamiltonian. Indeed, strongly non-Fermi liquid behavior has been observed in a variety of DC transport experiments, in very good agreement with theoretical predictions. Here, we describe how *fractional quasiparticle charge*, a fundamental property of Luttinger liquids, can be observed in impurity-induced shot noise.

Pinning of stripes in cuprate superconductors

Simon Bogner and Stefan Scheidl
Universität zu Köln, Germany

We examine the effects of disorder on striped phases in high-temperature superconductors and related materials. In the presence of quenched disorder, pinning by the atomic lattice – which might give rise to commensuration effects – is irrelevant for two dimensional stripe arrays on large length scales. As a consequence, the stripes have divergent displacement fluctuations and topological defects are present at all temperatures. Therefore, the positional order of the stripe array is short ranged with a finite correlation length even at zero temperature. Thus lock-in phenomena can exist only as crossovers but not as transitions. In addition, this implies the glassy nature of stripes observed in recent experiments.

Control of spin in quantum dots with non-Fermi liquid correlations

A. Braggio, M. Sassetti and B. Kramer
University of Genoa, Italy

Spin effects in the transport properties of a double barrier quantum wire with spin-charge separation are investigated. It is found that the non-linear transport spectra are dominated by spin dynamics. Applying a local magnetic field to the dot strong spin polarization effects are observed. They can be controlled by varying gate and bias voltages. Complete polarization is stable against interactions. When polarization is not complete it is power-law enhanced by non-Fermi liquid effects. Periodic features as a function of the magnetic field are observed for the Coulomb peaks.

Quantum Hall Effect: the resistivity of a two-dimensional electron gas using a thermodynamic approach

M.V. Cheremisin

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We propose a mechanism [1] which allows to explain quantitatively the oscillations in longitudinal resistivity of 2D electron gas placed in strong magnetic field. We have used Barraf and Tsui abandoned model [2] according to which the quantum Hall plateaux originate from the pinning of 2DEG chemical potential by an external carriers reservoir. We investigate dissipationless 2DEG with the conductivity tensor known to be purely off-diagonal within strong quantum limit. We demonstrate that an extraneous longitudinal resistivity is, nevertheless, generated in sample as a result of Peltier and Seebeck thermo-electric effects combined [3, 4]. The current causes heating(cooling) at the first(second) sample contact due to the Peltier effect. The contacts temperatures are different, the temperature gradient is linear downstream the current. The measured voltage is equal to the Peltier effect-induced thermoemf which is *linear* in current. As a result, the measured longitudinal resistivity is nonzero as $I \rightarrow 0$. The latter shown to be a universal function of magnetic field and temperature, expressed in fundamental units h/e^2. The analytical results are in a good agreement with experimental data for temperature, current and sample width dependent scaling. Moreover, our approach point to universality of so-called "QH transitions" and current-polarity dependent QHE breakdown. The author is grateful to Prof. M.Dyakonov for critical remarks.

References

[1] M.V.Cheremisin, cond-mat/0102153, submitted to PRL

[2] G.A.Barraf, D.C.Tsui, Phys.Rev.B, **24**, 2274, 1981

[3] C.G.M.Kirby, M.J.Laubitz, Metrologia, **9**, 103, 1973

[4] M.V.Cheremisin, Sov. Phys. JETP, **92**, 357, 2001

$\pi - 0$ Transition in Superconductor-Ferromagnet-Superconductor Junctions

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Superconductor-Ferromagnet-Superconductor (SFS) Josephson junctions are known to exhibit a transition between π and 0 states. In this note we find the $\pi - 0$ phase diagram of an SFS junction depending on the transparency of an intermediate insulating layer (I). We show that in general, the Josephson critical current is nonzero at the $\pi - 0$ transition temperature. Contributions to the current from the two spin channels nearly compensate each other and the first harmonic of the Josephson current as a function of phase difference is suppressed. However, higher harmonics give a nonzero contribution to the supercurrent.

Interaction Induced Restoration of Phase Coherence

A. A. Clerk, P. W. Brouwer, and V. Ambegaokar
Laboratory of Atomic and Solid State Physics, Cornell University

We study the conductance of a quantum "T-junction" coupled to two electron reservoirs and a quantum dot. In the absence of electron-electron interactions, the conductance g is sensitive to interference between trajectories which enter the dot and those which bypass it. We show that including an intra-dot charging interaction has a marked influence– it can enforce a coherent response from the dot at temperatures much larger than the single particle level spacing Δ. The result is large oscillations of g as a function of the voltage applied to a gate capacitively coupled to the dot. Without interactions, the conductance has only a weak interference signature when $T > \Delta$.

Mott transition for bosonic ladders

Patrick Donohue and Thierry Giamarchi
LPS, Université Paris-Sud, Orsay

We study a model of strongly interacting bosons on a clean ladder with one boson to every site. As the inter-chain hopping is varied we study the superfluid-insulator transition. The transport properties of such a model are described.

The connection to possible experimental realisations are briefly discussed.

Critical exponents of the random-field $O(N)$ model

D.E. Feldman
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The critical behavior of the random-field Ising model has been a puzzle for a long time. Different theoretical methods predict that the critical exponents of the random-field ferromagnet in D dimensions are the same as in the pure $(D-2)$-dimensional ferromagnet with the same number of the magnetization components. This result contradicts the experiments and simulations. We calculate the critical exponents of the random-field $O(N)$ model with the $(4+\epsilon)$-expansion and obtain values different from the critical exponents of the pure ferromagnet in $2+\epsilon$ dimensions. In contrast to the previous approaches we take into account an infinite set of relevant operators emerging in the problem. We demonstrate how these previously missed relevant operators lead to the breakdown of the $(6-\epsilon)$-expansion for the random-field Ising model. The mechanism of the breakdown of the renormalization group is similar to that for the problem of metal-dielectric transition.

Can backscattering off an impurity enhance the current?

D.E. Feldman and Y. Gefen

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It is well known that while forward scattering has no effect on the conductance of one-dimensional systems, backscattering off a static impurity suppresses the current. We study the effect of a time-dependent point impurity on the conductance of a one-channel quantum wire. At strong repulsive interaction (Luttinger liquid parameter $g < 1/2$), backscattering renders the conductance greater than its value e^2/h in the absence of the impurity. A possible experimental realization of our model is a constricted Hall bar at fractional filling factors $\nu = 1/(2n+1)$ with a time-dependent voltage at the constriction. Another related problem is the effect of phonon pulses on Luttinger liquid systems.

Kondo Effect from Ferromagnetic Nanoclusters

Gregory A. Fiete, Gergely Zarand, Bertrand I. Halperin

Harvard University, USA

Recent scanning tunneling microscope (STM) experiments have studied the spectroscopy of nanometer and sub-nanometer sized ferromagnetic (Co) clusters adsorbed on the surface of a metallic host. The superb spatial resolution of the STM permits a careful study of size-dependent spectroscopy of these clusters, which may exhibit Kondo effect. Motivated by these experiments, we study, theoretically, spin-flip scattering of electrons from finite size ferromagnetic impurities adsorbed on metallic surfaces. We introduce two models of nanometer sized ferromagnets–1) An itinerant model with delocalized s, p and d electrons and 2) A model with a rigid d-level spin and only s-states delocalized. In the limit of weak tunneling between a ferromagnetic nanocluster and a metallic host, we show that only the itinerant model results in an antiferromagnetic exchange coupling between the cluster and the conduction electrons. Thus, in the case of weak tunneling, Kondo effect is only possible for the itinerant model. For the case of strong tunneling between the cluster and the metal, the second model provides a more natural description and leads to a Kondo effect. We also calculate the spectral function for a small ferromagnetic cluster.

Critical Temperature of Superconductor/Ferromagnet Bilayers

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Department of Applied Physics, University of Twente, Enschede, The Netherlands

Superconductor/ferromagnet bilayers are known to exhibit nontrivial dependence of the critical temperature T_c on the thickness d_f of the ferromagnetic layer. We develop a general method for investigation of T_c as a function of the bilayer's parameters. As a result, we obtain different types of nonmonotonic $T_c(d_f)$ behavior, such as minimum of T_c and even reentrant superconductivity. Qualitatively, we show that it is interference of quasiparticles that makes $T_c(d_f)$ a nonmonotonic function. The results are in good agreement with experiment. Our method also applies to multilayered structures.

Dynamic Approach to Mesoscopic Systems under AC Pump

E. Kanzieper, V. I. Yudson, and V. E. Kravtsov
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The ac electric field applied to small mesoscopic samples causes two basic effects – the electron dephasing and the heating of the electron gas which drives a system outwards of equilibrium. Adequate theoretical description of these phenomena requires taking into account the effects of the electron-field interaction to all orders in external ac electric field. In the present communication, we formulate a dynamic approach to describe a nonlinear response of pumped disordered conductors of various geometries. We 1) oppose closed disordered systems with open ones, 2) show that physical observables may and may not be sensitive to the heating effects (Kubo vs Landauer conductances), and 3) demonstrate that zero-dimensional sector of the theory strongly depends on the geometry of conductor (dot vs ring) leading to two different time-dependent random matrix theories in the limit of low- and high-frequency pumping field.

References

V. I. Yudson, E. Kanzieper, and V. E. Kravtsov, cond-mat/0012200, to appear in Phys. Rev. B (2001)

Wave function correlations on the ballistic scale: from quantum disorder to quantum chaos

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We study spatial correlations of wave functions in a two-dimensional chaotic system. Recently, a hypothesis was put forward [1] (generalizing an earlier conjecture by Berry [2]) that the wave fuction fluctuations are Gaussian. This conjecture, however, has not been proven in view of limitations of semiclassical methods used in [1,2]. Furthermore, its limits of validity and meaning of energy averaging have not been understood. In particular, if applied to the whole system, this conjecture violates the eigenfunction normalization. We use the σ-model approach allowing for a systematic study of the wave function statistics [3]. The ballistic σ-model is derived by averaging over an additional weak and smooth disorder which does not change the classical dynamics in the system but generates an ensemble of quantum systems. We prove that at short scales the wave function statistics is indeed Gaussian. This is true, however, only at a distance below the single-paticle (quantum) mean free path determined by averaging. At larger distances the statistics is strongly non-Gaussian and is shown to be determined by classical dynamics in the system. As another application, we calculate the wave function statistics in a random magnetic field. In this case, our approach of averaging over an additional weak quantum disorder allows us to overcome the problem of infrared divergence and non-gauge-invariance of the single-particle relaxation rate in the random magnetic field.

References

[1] S. Hortikar and M. Srednicki, Phys. Rev. Lett. **80**, 1646 (1998); Phys. Rev. **E** 57, 7313 (1998).

[2] M. V. Berry, J. Phys. A **10**, 2083 (1977)

[3] Ya. M. Blanter, A. D. Mirlin, and B. A. Muzykantskii, Phys. Rev. Lett. **80**, 4161 (1998); cond-mat/0011498.

Coulomb Drag Between Quasiballistic Quantum Wires: an Indication of Non-Fermi-Liquid Behavior

R. Klesse*, P. Debray, V. Zverev , O. Raichev, P. Vasilopoulos, and M. Rahman

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The Coulomb drag between two spatially separated, 2 μm long lithographically defined quantum wires has been studied experimentally in the absence of interwire tunneling. The drag resistance R_D shows peaks when the 1D subband bottoms of the wires are aligned and the Fermi wave vector k_F is small. R_D decreases exponentially with the interwire separation *d*. In the temperature range $0.2K \leq T \leq 1K$ the drag signal shows the *power-law dependence* $R_D \propto T^x$ with x ranging from -0.61 to -0.77 depending on the magnitude of k_F. We interpret our experimental results in the framework of the Tomonaga-Luttinger liquid theory.

Full counting statistics of a general quantum mechanical variable

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We present here a quantum mechanical framework for defining the statistics of measurements of $\int dt\hat{A}(t)$ where $A(t)$ is a quantum mechanical variable. This is a generalization of the so-called full counting statistics proposed earlier for DC electric currents.

We develop an influence functional formalism that allows us to study the quantum system along with the measuring device thus fully accounting for the action of the detector on the system to be measured. We define the full counting statistics (FCS) of an arbitrary variable by means of an evolution operator that relates initial and final density matrices of the measuring device. We suggest two schemes whereby the so defined statistics can be observed experimentally.

The work is motivated by a recent calculation of the FCS for superconducting systems. In certain situations the probability distributions obtained according to an earlier interpretation of the FCS are not strictly positive. This inconsistency can be removed by a reinterpretation in the framework that we will develop.

Conductance Sum Rule in Atomic Break Junctions

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In recent experiments on nanoscale break junctions E. Scheer et al. [PRL 78, 3535 (1997)] were able to show that the conductance of the junction is determined by the atomic orbitals. Surprisingly, in several materials the total conductance is almost quantized although the transmission of each channel shows a strong variation while the junction is elongated.

We argue that the low energy behavior of nanoscale break junctions can be described by a multi-level Anderson impurity model. For this model we derive a generalization of the unitarity sum rule to multiple transmission channels. This approximate sum rule offers an explanation for the quasi-quantization of the conductance observed in experiments.

Screening effects in Kondo lattices

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Effective action and Ginzburg-Landau functional is derived for the Kondo lattice model in the vicinity of antiferromagnetic (AFM) and spin-glass (SG) transition points. The interplay between the inter-site magnetic correlations and Kondo effect is considered in the framework of the semi-fermionic representation of SU(2) spin operators. In this representation the local spins are replaced by a bilinear combination of Fermi operators with imaginary chemical potential providing an exact treatment of the local constraint. It is shown that Kondo screening suppresses the magnetic order but enhances the spin-liquid type short-range correlations for the case of competing RKKY and Kondo interactions. The modified Doniach diagram is constructed for two different cases of clean and disordered magnets.

Energy Spectrum of Quantum Bars

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We consider a periodic grid consisting of two arrays of $1D$ quantum wires parallel to the x_1 and x_2–directions with the angle θ between them ("quantum bar"). The interaction between electrons in intersecting wires is a point–like contact capacitive coupling in the nods of the bar. It is assumed that interaction is weak enough, so the energy spectrum of coupled Luttinger liquids is calculated in two–wave mixing approximation. It is shown that in this case the energy spectrum conserves quasi $1D$ character of Luttinger–like liquid in the most part of the phase space, however special directions in (k_1, k_2) space exist where the wave functions of the electrons in two arrays are strongly mixed and the $2D$–effects are significant.

Zeeman smearing of the Coulomb-Kondo staircase: (Example of point-like backscattering effect in magnetic field)

Karyn Le Hur
Université de Genève

Charge fluctuations of a **large** dot coupled to a two-dimensional lead via a **good** single-mode Quantum Point Contact (QPC) and capacitively coupled to a back-gate, are investigated in presence of a **parallel** magnetic field. Matveev investigated the capacitance between the gate and the lead in the two extreme limits of zero magnetic field (which corresponds to the symmetric two-channel QPC model) and of very high fields (which corresponds to the one-channel QPC model). Here, I carefully describe the zero-temperature crossover from the two- to the one-channel QPC model, and finally make predictions for the (conductance and) capacitance behavior(s) at low magnetic fields. In particular, I show that **already** at low fields, the capacitance exhibits — instead of a logarithmic Matveev singularity — a reduced peak as a function of gate voltage, which could be finally observed experimentally.

A quantitative analysis of the smearing out of the logarithmic peak for the capacitance is performed and the link with the two-channel **anisotropic** Kondo model at the Emery-Kivelson line is explained.

Optimal Fluctuations and Tail States of non-Hermitian Operators

F. M. Marchetti and B. D. Simons
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A statistical field theory is developed to explore the density of states and spatial profile of 'tail states' at the edge of the spectral support of a general class of non-Hermitian operators. These states, which are identified with symmetry broken, instanton field configurations of the theory, are closely related to localised sub-gap states recently identified in disordered superconductors. By focussing on the problems of a quantum particle propagating in a random imaginary scalar potential, and a constant imaginary vector potential, we discuss the methodology of our approach and the universality of the results. Finally, we address potential physical applications of our findings.

Dimensional crossover of local density of states fluctuations in disordered pillars, wiresand films

Edward McCann and Vladimir I. Fal'ko

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We present a theoretical analysis of correlation properties of the local density of states in a disordered emitter probed by resonant tunnelling through a localized impurity state. We give analytic expressions for the variance and for correlations of the differential conductance with respect to voltage and applied magnetic field for different limits of effective dimensionality of the emitter, namely, bulk three dimensional, a film, a wire, and a pillar, and we determine the effect of magnetic anisotropy in low dimensions. A numerical calculation is performed in order to describe the crossovers between these limits where the correlation functions are sensitive to the shape of the emitter and the position of the resonant impurity. The aim is to provide a means of analyzing fluctuation data obtained experimentally and, in particular, it is possible to extract information about the efficiency of electron-electron interaction induced relaxation of a 'hole' below the Fermi level created in the emitter after the tunnelling event.

Manifestations of the Berry-Robnik symmetry effect in normal and superconducting systems

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The transport and spectral properties of two-dimensional electron gases as well as superconducting films are modified by parallel magnetic fields that break time-reversal symmetry. However, due to the Berry-Robnik phenomenon [1], in the presence of $z \longrightarrow -z$ inversion symmetry, characteristics reminiscent of the time-reversal invariant system persist.

In the normal system, this manifests itself in non-vanishing weak localization corrections to the conductance [2]. Deviations from the fully symmetric case lead to magnetoconductance profiles that contain information on both, the geometry of the confining potential and the nature of the disorder.

Superconducting films subject to parallel magnetic fields display a gapless phase, where the order parameter is still finite, but the quasi-particle energy gap vanishes. While the gap suppression is not affected by the presence of an additional symmetry, we find that the low-energy properties within the gapless phase depend sensitively on geometric details [3].

References

[1] M. Robnik and M.V. Berry, J. Phys. A **19**, 669 (1986).

[2] J.S. Meyer, A. Altland, and B.L. Altshuler, preprint cond-mat/0105623.

[3] J.S. Meyer and B.D. Simons, unpublished.

Large enhancement of shot–noise in a single–electron transistor device

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We analyze the sequential tunneling through two capacitively coupled single electron transistors (SETs). Consideration are restricted to the case when the central electrodes (islands) of the transistors are atomic–size, which means each of them has only one single electronic level available for the tunneling processes.

In the stationary state, the bias voltage dependence of the current flowing through the SETs demonstrates negative differential resistance (NDR) due to Coulomb interaction of charge accumulated on both islands. In general, the current shot–noise is suppressed below the Poissonian value due to negative correlations between tunneling electrons. It was found an enhancement of the current shot–noise (much above Poissonian value) in the NDR range. The spectral decomposition analysis indicated on the two main contributions to the shot–noise: low frequency and high–frequency fluctuations. It was shown that for a strong enhancement of the current shot–noise are responsible the fluctuations of the polarization (a low frequency part).

Experimental measurements of electronic transport concern the stationary currents only.[1] We believe that the power spectrum studies will be also undertaken and can verify our theoretical predictions.

The work in this paper was supported by the State Committee for Scientific Research Republic of Poland under Grants No. 2 P03B 140 19 and 2 PO3B 087 19.

References

[1] C. P. Heij, D. C. Dixon, P. Hadley and J. E. Moij, Appl. Phys. Lett. 74, 1042 (1999)

Exact Correlation Functions for the BCS model in the canonical ensemble

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We evaluate correlation functions of the BCS model for finite number of particles. The integrability of the Hamiltonian relates it with the Gaudin algebra $\mathcal{G}[sl(2)]$. Therefore, a theorem that Sklyanin proved for the Gaudin model, can be applied. Several diagonal and off-diagonal correlators are calculated. The finite size scaling behavior of the pairing correlation function is studied.

Density of Prelocalized States in a Mesoscopic SNS Junction

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Quasiclassical theory predicts an existence of a sharp energy gap $E_g \sim \hbar D/L^2$ in the excitation spectrum of a long diffusive superconductor–normal metal–superconductor (SNS) junction. We show that mesoscopic fluctuations remove the sharp edge of the spectrum, leading to a nonzero DoS for all energies. Physically, this effect originates from the quasi-localized states in the normal metal. Technically, we use an extension of Efetov's supermatrix σ-model for mixed NS systems. A non-zero DoS at energies $E < E_g$ is provided by the instanton solution with broken supersymmetry.

Kondo effect in Coulomb blockade systems

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At temperatures well below the single particle level spacing in a quantum dot, the transport through it is dominated by the Kondo effect. Until recently,

it was generally believed that the Anderson impurity model provides an accurate description of this phenomenon. The model predicts a monotonic increase of the conductance across the dot with a non-zero spin as temperature is lowered, reaching the quantum limit $G \sim e^2/h$ at $T = 0$. We show that this simple picture is *qualitatively* incorrect in some cases. For example,

if the spin of the dot S exceeds $1/2$, the temperature dependence of the conductance is non-monotonic: its initial increase is followed by a drop when temperature is lowered.

Coulomb blockade of tunneling between disordered conductors

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We study the influence of Coulomb interaction on the current–voltage characteristics of tunnel junctions between disordered conductors with large lateral extension. The conductance shows a zero–bias anomaly due to electron–electron interactions within the electrodes and electron–hole interactions between them. The attractive electron–hole interactions are essential for a correct treatment of tunnel junctions and prevent a simple description of interaction effects in terms of modified densities of states of the two electrodes. The Coulomb interactions are treated non–perturbatively in order to recover the full conventional theory of Coulomb blockade for ultrasmall tunnel junctions and to avoid singularities for small voltages which arise in the well–known diffusive anomalies. We give explicit results for one– and two–dimensional junctions and include finite size effects. This allows to consider the limit of zero–dimensional junctions and the associated crossover to the conventional Coulomb blockade effect.

Charge fluctuation induced dephasing in a gated mesoscopic interferometer

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We investigate the reduction of the amplitude of Aharonov-Bohm oscillations in a ballistic one-channel mesoscopic interferometer due to charge fluctuations. In the arrangement considered the interferometer has four terminals and is coupled to macroscopic metallic side-gates. The Aharonov-Bohm oscillation amplitude is calculated as a function of temperature and the strength of coupling between the ring and the side-gates. The resulting dephasing rate is linear in temperature in agreement with recent experiments. Our derivation emphasizes the relationship between dephasing, ac-transport and charge fluctuations.

Pairbreaking in s-wave superconductors due to two-channel Kondo impurities

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We investigate the signature of the two-channel Kondo effect in the presence of an s-wave superconductor. As a possible realization of the two-channel Kondo effect we consider (1) magnetic impurities with an orbital degeneracy of the ground state and (2) lattice defects with an internal degenerate degree of freedom. In both cases we use an Anderson impurity model which we evaluate within the Non-Crossing-Approximation (NCA), generalized to include anomalous contributions to the Green's function in the superconducting state. We calculate the sub-gap structure of the density of states as well as the reduction of the transition temperature T_c as a function of the impurity concentration.

Fractional Charge Tunneling

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Tunneling of quasi-particle in the quantum Hall regime is studied theoretically on a torus. This geometry is chosen, as it allows tunneling of fractional charge through a potential barrier without changing the amount of total charge on the sample, constrained to be an integer multiple of electron charge. The work of Haldane and Rezayi regarding Laughlin's function on a torus is reviewed and extended by building a variational wave function for the case of a torus with the barrier. Electron tunneling (in the integer regime) is compared to a fractional-charge tunneling occurring at fractional filling.

Tunneling at $\nu = 1$: Goldstone modes and Excitons

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Two dimensional electron systems exhibit a dizzying array of novel quantum states. In particular the presence of a large perpendicular magnetic field "quenches" the electron's kinetic energy, increasing the importance of electron-electron interactions. These strong interactions lead to the famous fractional quantum hall effect, and the associated (composite-)fermi-liquid at Landau level filling factor $\nu = 1/2$. The addition of a second two-dimensional electron system parallel to the first allows for new interlayer-correlated ground states. Among these new states are quantum hall states at total filling factors $\nu_T = 1, 1/2$ and $1/4$. The state at $\nu = 1$ is expected to be particularly bizarre, and can be thought of as a Bose condensate of excitons.

In interlayer tunneling we find a near discontinuity in the tunneling current at zero bias, strongly reminiscent of the Josephson effect. Associated with this discontinuity, we observe a dramatic enhancement of the zero bias tunneling conductance (dI/dV), whose magnitude can exceed that at zero magnetic field by a factor of 150, and whose width is decreased by 15 times!

The only low energy mode of this system is expected to be a linearly dispersing Goldstone mode. The application of an in-plane magnetic field creates a wave vector q, and splits the central conductance peak, and be measuring the q dependence of this energy splitting we construct the dispersion relation of this mode and find good agreement with theory. However, contrary to theory, a large central peak remains even at large q.

Hidden Symmetry in Hall states

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This poster gives an introduction to the braiding of the quasihole excitations over certain quantum Hall states and it shows how one can describe this braiding algebraically by making use of a hidden quantum group symmetry. As an example, we give an explicit description of the braiding for the series of states proposed by N. Read and E. Rezayi (`cond-mat/9808384`), which we constructed in our preprint `cond-mat/0104035`. These results generalise earlier results of C. Nayak and F. Wilczek (`cond-mat/9605145`)

Quantum interference and the formation of the proximity effect in chaotic normal-metal/superconducting structures

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We discuss a number of basic physical mechanisms relevant to the formation of the proximity effect in superconductor/normal metal systems. In particular, we discuss the impact of quantum diffractive scattering on the structure of the density of states in the normal region. We consider ballistic systems weakly disordered by pointlike impurities as a test case and demonstrate that diffractive processes akin to normal metal weak localization lead to the formation of a hard spectral gap. Turning to the more difficult case of clean systems with chaotic boundary scattering, we argue that semiclassical approaches, based on classifications in terms of classical trajectories, cannot explain the hard-gap phenomenon. Employing an alternative formalism based on elements of quasiclassics and the ballistic σ-model, we demonstrate that the inverse of the Ehrenfest time is the relevant energy scale in this context.

Andreev reflection due to electron-magnon interaction in ferromagnet-superconductor junctions

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We show [1] that electron-magnon interaction at a ferromagnetic metal - superconductor interface leads to a new process of magnon-assisted Andreev reflection, which consists of the simultaneous injection of a Cooper pair from the superconductor and the emission of a magnon inside the ferromagnet. At low temperature this process represents an additional channel for subgap transport across an FS interface, which lifts restrictions on the current I resulting from the necessity to match spin-polarized current in the ferromagnet with spin-less current in the superconductor. We calculate I using the tunneling Hamiltonian method and the nonequilibrium (Keldysh) Green functions technique generalized for describing contacts with ferromagnetic electrodes. It is shown that for a junction between a superconductor and a ferromagnet with an arbitrary degree of polarization, the inelastic magnon-assisted Andreev reflection process would manifest itself as a nonlinear addition to the $I(V)$ characteristics which is asymmetric with respect to the sign of the bias voltage and is related to the local density of states of magnons at the interface. The $(dI/dV) - V$ curves measured in Ref. [2] clearly demonstrated asymmetry in the range of small voltages which is consistent with that predicted by our theory. Expressions for the subgap $I(V)$ characteristics are given for arbitrary interfacial quality whilst the limiting cases of uniformly transparent and disordered interfaces are discussed in detail.

References

[1] E. McCann and V.I. Fal'ko, cond-mat/0010421; G. Tkachov, E. McCann and V.I. Fal'ko, cond-mat/0106161.

[2] J. Y. T. Wei, N.-C. Yeh, C. C. Fu, and R. P. Vasquez, J. Appl. Phys., **85**, 5350 (1999).

The Influence Of The Dot-Lead Couplings On The Conductance Peak Spacings

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In recent experiments in the Coulomb blockade regime [1], the statistics of conductance peak spacings was studied for a partially open quantum dot. The experiments showed enhancement of the even-odd parity effect upon opening up a quantum dot. This problem has been theoretically addressed in the framework of the constant interaction model [2].

However, it has become clear recently [3] that the interaction between electrons in a quantum dot should be described by the Universal Hamiltonian. Since spacings between energy levels of the quantum dot fluctuate, even for weak exchange interaction, spins higher than 0 and $1/2$ are allowed [4, 3].

We found that the enhancement of the even-odd parity effect is smaller for a real quantum dot than for a one described by the constant interaction model. Moreover, at sufficiently large exchange interaction (or gas parameter r_s) the effect can be substantially suppressed.

References

[1] Jeong, H., Chang, A. M., et al., unpublished (2000); Maurer, S. M., Patel, S. R., Marcus C. M., et. al., Phys. Rev. Lett. **83**, p.1403 (1999)
[2] Kaminski, A., Glazman, L. I., Phys. Rev. B **61**, p.15927 (2000)
[3] Kurland, I. L., Aleiner, I. L., Altshuler, B. L., cond-mat/0004205; Aleiner, I. L., Brouwer, P. W., Glazman, L. I., cond-mat/0103008
[4] Brouwer, P. W., Oreg, Y., Halperin, B. I., Phys. Rev. B **60**, p.13977 (1999); Baranger, H. U., Ullmo, D., Glazman, L. I., Phys. Rev. B **61**, p.2425

Can Berry phase survive in a system that is not isolated from its environment.

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We investigate how the Berry phase of a system is affected by that system's interaction with its environment. This environment broadens the system's energy levels, so its spectrum is no longer discrete. We wish to know the conditions under which the Berry phase is measurable in such a system. In those cases where it is measurable, what is its value?

To answer these questions we consider a spin half in a slowly rotating magnetic field, with the spin also coupled to an environment of harmonic oscillators. We treat the coupling between the spin and the oscillators as a perturbation, but concentrate on the special case where we can sum the perturbation expansion to all orders. We find the Berry phase can be measured but only if the rotation of the magnetic field is neither fast nor very slow. What-is-more the Berry phase is modified by the presence of the environment and no longer has a simple geometric interpretation.

Field Theory of Strongly Correlated Fermions and Bosons in Low-Dimensional Disordered Systems

Great Park, Windsor UK, August 13-26, 2001

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